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ENERGY $AVER$

"For Business and Industry"

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EFFECTIVE SAVINGS FROM ENERGY EFFICIENT ELECTROMAGNETIC BALLASTS

The Facts...

The heart of every fluorescent light fixture is its ballast. The greater operating efficiency of today's ballasts can help building owners and operators save significantly on their electrical costs.

Energy-saving electromagnetic ballasts coupled with low wattage fluorescent tubes can easily reduce energy costs by up to 25 per cent compared with standard ballasts and tubes.

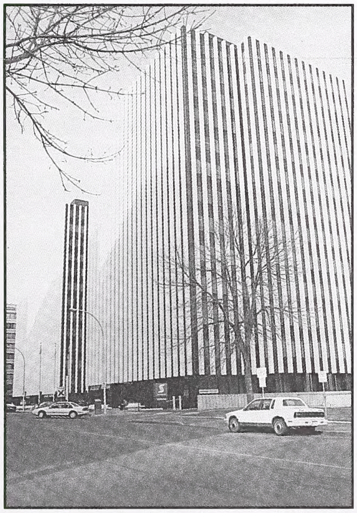
A fluorescent lamp consists of a glass tube containing two electrodes, a coating of phosphor and a low pressure mixture of mercury and an inert gas such as argon. The electrodes at each end of the tube provide a source of free electrons which initiate a mercury arc.

Every type of fluorescent lamp requires a ballast — an electrical or electronic device which provides the proper voltage to start the lamp. The ballast then stabilizes the mercury arc by limiting the current to proper levels.

Major innovations in design and construction have reduced ballast wattage loss by almost 50 per cent. The copper wiring used in energy-saving ballasts has been redesigned so that greater surface contact is achieved. This and usage of better core materials have increased the efficiency of electromagnetic ballasts. The greatly reduced wattage results in cooler operating temperatures which tends to increase the life of the ballast and results in reduced air conditioning load.

Operating two 34-watt energy-saving lamps with an energy-efficient ballast consumes about 72 watts of power compared with 82 watts for standard ballasts. This means about 10 watts of energy or 12 per cent can be saved per fixture.

Canadian provinces are following the lead of U.S. federal energy legislation in recognizing that energy-saving ballasts are the logical ballast choice. In the near future, possibly only energy-conserving types will be available to the Alberta consumer.


Petroleum Plaza in Edmonton.

Building owners and operators can reduce their energy costs by converting conventional ballasts to energy-efficient electromagnetic types. Normally, this is done as old ballasts burn out.

This energy-saving technology applies to many types of fluorescent fixtures and different length tubes, for example three-foot, four-foot and eight-foot lengths. Energy-efficient ballasts are also available for high output fixtures as may be found outdoors. Such ballasts have a median life expectancy of about 12 to 15 years if operated under normal conditions.

Energy-saving electromagnetic ballasts cost between $3 and $5 more than standard ballasts from a wholesaler, depending on the voltage. In Alberta, voltages of 120, 277 and 347 are used. The 277-volt ballasts are the most expensive as they are manufactured in the United States. When dealing with a contractor, an additional 30 per cent could be added to the wholesale price for estimating purposes. Ordering 100 ballasts or more could reduce the cost by about 10 per cent.

A more expensive ballast alternative is available in the form of electronic ballasts which can achieve savings in the range of 30 to 70 per cent, depending on the type used.

The least expensive electronic ballast currently available is twice the price of an energy-efficient electromagnetic ballast — about $30.

Greater energy savings over standard tubes and ballasts can be achieved by matching electronic ballasts with new 32-watt T-8 type lamps. When purchasing electronic ballasts, facility operators should make sure the ballast has a harmonic distortion of less than 10 per cent and a power factor of 90 or more.

In Alberta, about 86 per cent of office building lighting is fluorescent. Replacing existing ballasts with energy-saving ones as they burn out is a low-cost way for building managers to power up their savings.

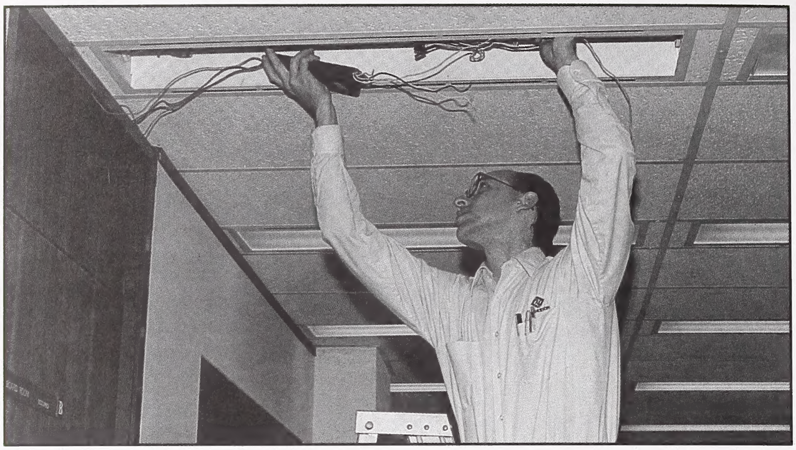
The Application...

Petroleum Plaza, built in 1972 and owned and operated by Princeton Developments Ltd., is a twin-tower office complex in downtown Edmonton which houses a number of government and private sector offices. Each tower has 13 floors with a combined floor area of 302,000 square feet (28,066 square metres).

In November 1991, Alberta's Energy Bus visited the two towers to assess the energy use and identify ways for the owners to save on energy costs.

Property manager, Buddy Perry, says prior to the audit his company had started to look at ways to save energy. A program to change the standard 40-watt fluorescent tubes to energy-saving 34-watt tubes had already been implemented.

"Any ballast that is weak will often burn out when you put in new tubes," says Perry. "So when we relamped, we changed quite a few of the existing ballasts to energy-saving ballasts."



A building maintenance employee at Petroleum Plaza with an energy saving ballast.

During the audit, the Energy Bus team estimated building owners could save about $43,750 per year on electrical costs if all the fixtures were converted to energy-efficient tubes and ballasts. Almost half of those savings, $18,000, could be attributed to the ballast conversion.

The estimate was based on approximately 400 fixtures per floor times 12 floors in each tower or 9380 fluorescent lights being operated an average of 60 hours per week, 50 weeks of the year. Lights were typically turned off during statutory holidays and over the Christmas break.

Since the ballasts were being changed as they burned out, the true cost of conversion was the difference between the cost of the standard ballast and the energy-saving ballast — about $3 to $5. To date, the building owner has converted about 3400 fixtures to more efficient ballasts. The projected annual savings for this conversion can be determined as follows: 3400/9380 x $18,000 = $6,524.

To calculate the payback on the investment in energy-saving electromagnetic ballasts as the old ones burn out, capital costs are divided by net savings = $10,200/$6,524 x 12 months = 18.8 months.

"Our electrical costs are down substantially," says Perry. "We definitely have savings."

The Bottom Line...

A simple conversion to energy-saving ballasts as the old ballasts burn out is a low cost way for building owners to save significantly on their annual electrical bill.

Replacing a standard ballast with an energy-efficient type will save about 10 watts of power per two-lamp four-foot fixture. To determine the number of kilowatts you can save per hour, multiply 10 watts times the number of fixtures in your building divided by 1000.

Both demand — kilovolt amperes (kV•A) or kilowatts (kW) — and energy — kilowatt-hours (kW•h) — must be considered when determining possible savings. The demand portion of your electric bill is based on the maximum amount of power your facility uses at any point in time. It is monitored on your electric meter by the red and black needles. You can read your monthly billing demand off your electric bill. For additional information, refer to Volume 1, Number 3, Energy $aver$ fact sheet in this series, or for further explanation, contact your utility company.

Lighting loads add to monthly peak billing demand in the form of base load, either kV•A or kW depending on your meter type. Decreasing wattage on lighting or ballasts reduces the base load, in most cases, every month of the year. Lighting reductions also reduce that load over time, thus saving kW•h or energy.

To calculate your potential **energy** cost savings per year per 100 fixtures, you can use the accompanying graph (Figure 1). First, determine the number of hours your fluorescent lights operate per week. Locate that number along the horizontal axis and read up to a line that represents your last block energy cost per kilowatt hour from your latest electrical bill. Next, read across to the left to find the annual savings. Then, to get your total savings, multiply this figure by the number of fixtures in your building divided by 100.

To determine your **demand** savings per year per 100 fixtures, use Figure 2. First, determine the number of months over which the demand portion of your bill is applicable, by reviewing 12 months of your electric bills, or contact your electric utility for help. Find that number along the horizontal axis and read up to the line that represents the rate charged by your utility in kV•A or kW.

Then, read across to the left to determine the annual demand cost savings. Again, multiply this figure by the number of fixtures in your building divided by 100. To determine your total savings, add your energy and demand savings together.

The accompanying examples will help to illustrate the savings calculations.

EXAMPLE — ENERGY SAVINGS:

Type of fixture = two 34-watt fluorescent tubes
Existing ballasts = standard ballasts consuming 82 watts
Replacement ballasts = energy-efficient ballasts consuming 72 watts
Number of fixtures = 9380
Operating hours = 60 hours per week, 50 weeks/year
Lowest block energy cost = 2.51 cents

To use the example, find 60 hours per week on the horizontal axis. Read up to a line that represents 2.51 cents energy charge and across to the left to determine the annual savings per 100 fixtures — $75.29. To determine the yearly savings for 9380 fixtures, use the following formula: 9380/100 x $75.29 = $7062.20

EXAMPLE — DEMAND SAVINGS:

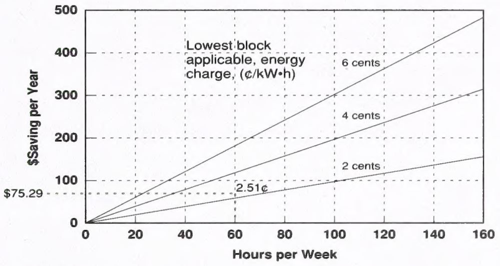
Same conditions as example above.
Number of months demand applicable = 12 months.
Lowest block demand charge = $9.66 per kW.

To use this example, find 12 months on the horizontal axis in Figure 2. Read up to a line that represents $9.66 and across to the vertical axis to determine the savings per year per 100 fixtures — $115.95. To calculate the yearly savings for 9380 fixtures, use the following formula: 9380/100 x $115.95 = $10,876.11.

Total energy and demand savings per year would be: $7062.20 + $10,876.11 = $17,938.31. To determine the yearly savings per ballast, divide the total savings by the number of ballasts: $17,938.31/9380 = $1.91. This saving must be considered over the life of the ballast — about 10 to 15 years — as well as the reduced air conditioning load each year. If each energy-saving ballast cost a $3 premium to purchase, a payback of approximately one-and-a-half years can be expected:

$$\frac{\$3.00 \text{ Premium/Ballast}}{\$1.91 \text{ Savings /Year}} = 1.57 \text{ years.}$$

FIG. 1 **BALLAST kW•h SAVINGS / 100 FIXTURES (10 watt savings/ballast)**



50 weeks per year operation

FIG. 2 **BALLAST kV•A or kW SAVINGS / 100 FIXTURES (10 watt savings/ballast)**

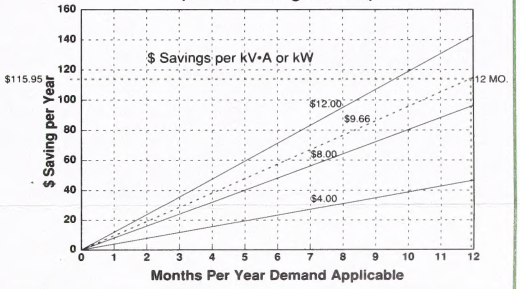
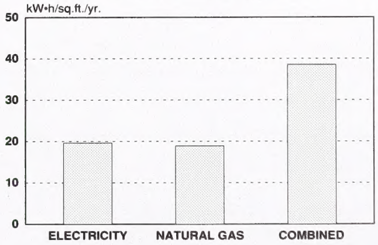


FIG. 3 **ENERGY USAGE – LARGE COMMERCIAL BUILDINGS 83 BUILDINGS > 100,000 sq.ft. (9290 m^2)**



Multiply by 10.76 to convert to kW•h/m^2/yr

SECTOR REVIEW

Energy use varies widely depending on the type of facility and the activities in that facility. This variation has been substantiated during Energy Bus audits of almost every type of building in Alberta.

Based on 83 audits of buildings with more than 100,000 square feet (9290 square metres) of floor area, an analysis of yearly energy use of natural gas, electricity and combined electricity and natural gas is given in Figure 3.

Since the cost of a unit of energy is considerably higher for electricity than for natural gas, electricity accounted for 83 per cent of the total energy cost in these large office buildings, as indicated in Figure 4.

As shown in Figure 5, lighting averages 33 per cent of total electrical use in the large office/commercial building sector. Fluorescent lighting represents the most significant portion (about 80 to 85 per cent) of this lighting use.

The energy audit database shows that for building owners in Alberta, lighting use typically ranges from a low of 32 per cent for restaurant/taverns to 55 per cent in the storage/warehouse sector to a high of 74 per cent for motor vehicle dealers.

These statistics indicate that significant savings can be achieved by replacing standard ballasts with energy-efficient types in all sectors where fluorescent lighting is used. Up to 50 per cent of standard ballast losses can be avoided by energy efficient electromagnetic ballast technology.

FIGURE 4

LARGE COMMERCIAL BUILDINGS
83 Buildings > 100,000 sq.ft. (9290m²)

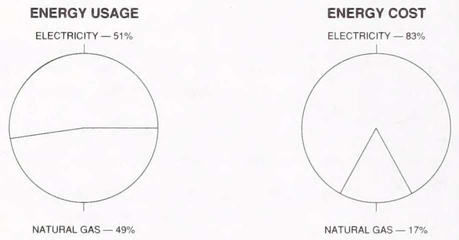
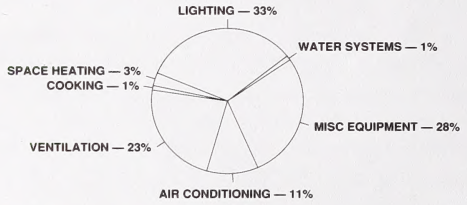


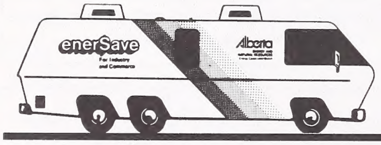
FIGURE 5

ELECTRICAL BALANCE
LARGE COMMERCIAL BUILDINGS
> 100,000 sq.ft. (9290m²)



FOR MORE INFORMATION

The article *Effective Savings From Energy Efficient Electromagnetic Ballasts* was researched and written by Jim Riddell and Carol Miyagawa. The Energy Efficiency Branch gratefully acknowledges editorial reviews done by Norman Henze, Philips Electronics Limited; Jim Oddie, General Electric Limited; Paul Morrisey, Commercial Lighting Products; and Buddy Perry, Princeton Developments Limited.



ENERGY $AVER$

Energy $aver$ is a series of fact sheets about energy efficiency measures that have wide application in Alberta. Each issue highlights a different technology and its successful use in the province. The Sector Review summarizes energy use patterns of different facilities that have used Alberta's Energy Bus audit service. Comments, questions and suggestions are welcome.

Write or phone (collect) to be placed on the mailing list. You may also receive back issues or arrange for an Energy Bus audit (conducted at no charge).

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